



HUGLE INDUSTRIES

587 NORTH MATHILDA AVENUE  
SUNNYVALE, CALIFORNIA 94086

PHONE (408) 738-1700

Gentlemen:

Thank you for your inquiry on the new Hugle Industries Interval Timer (Process Controller). Enclosed please find our descriptive brochure on this piece of equipment.

Hugle Industries are manufacturers of special equipment for the semiconductor industry, including Epitaxial Reactors, Ultrasonic Lead Bonders, and fully automated (as well as manual) Doping Systems for diffusion and epitaxy. In addition, we do custom designing of this equipment to customer specifications. We also consult extensively for users, manufacturers, and future manufacturers of integrated circuits.

The enclosed card when filled out, stamped, and mailed will bring additional information on any of the Hugle Industries' equipment or services.

Very truly yours,

*W.B.Hugle*

Dr. W. B. Hugle  
President

WBH/rw

Encl: Card, G1, G2, G4, F1



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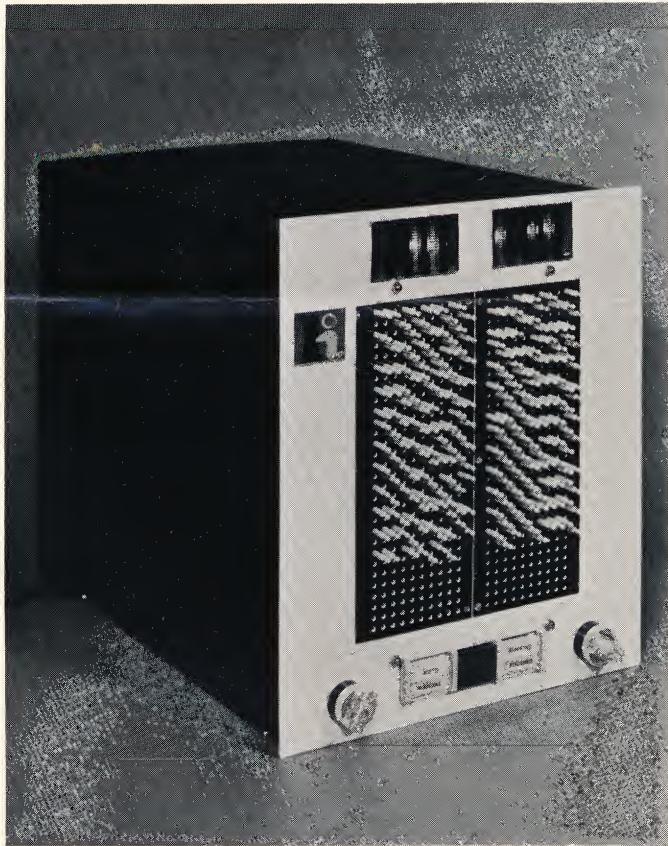
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**SOLID STATE  
INTERVAL TIMER  
and  
PROCESS CONTROLLER  
PCD Series**

**APPLICATIONS:**

Diffusion  
Epitaxy  
Food Packaging  
Vacuum Processing  
Thin Film Deposition  
Many Others



MODEL PCD 10

**FEATURES:**

- Fully automated solid state multi-channel process controller with 12 bit accuracy, plus 3 bit range suppression or expansion.
- Accurate electronic clock, based on integrated circuit 15 bit frequency generator, divides 2.4 hours into quarter second intervals.
- Fail safe circuit resets all lines to fail safe position in case of power interruption.
- Complete time conversion chart—no calculations necessary.
- Programmed by inserting taper pins into 20 x 30 matrix board through perforated plastic programming card.
- Two minutes to completely program 10 channels, including range selection.
- Off line program verification and storage.
- Resolution of standard model:

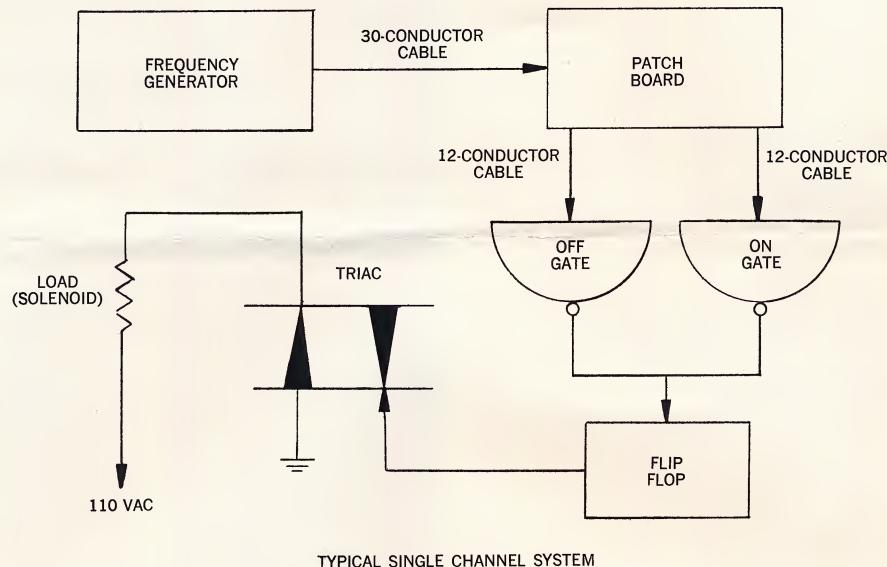
2 seconds in 2.4 hours or  
1 second in 1.2 hours or  
.5 second in .6 hour or  
.25 second in .3 hour  
Other ranges available.

Accuracy and repeatability on all ranges:  $\pm 4$  milliseconds.

## DESCRIPTION:

The Hugle Industries Interval Timer and Process Controller is a fully automated solid state special purpose computer specifically designed to sequence production operations with extreme accuracy, resolution, and repeatability. It eliminates operator error and assures consistency in such operations as epitaxy and diffusion. In industries such as food packaging, where multiple cam assemblies drive microswitch arrays, it replaces the entire cam-switch package, thereby eliminating down time due to switch failures and reducing change-over time from several hours to 2 or 3 minutes.

The PCD series is available in 5, 10, 15, 20, etc. channels. Each channel is independently programmed for turn on time and turn off time. Each channel terminates in a triac, a solid state relay, that switches up to 6A at 110V. The loads, which may be motors, solenoid valves, R.F. generators, electron beam guns, etc., are connected between the appropriate triac and line.



The control panel, or front of the instrument, contains the program board, and indicator light for each channel, indicating fuses, and lighted push buttons: one for main power on and off; one for manual mode vs automatic mode selection; and one to start the sequence.

## OPERATION:

Once the board is programmed, the operator simply checks that the power is on, and the manual/automatic switch is on "automatic" and then he (she) pushes the "start" button. The controller starts when the button is released. When the sequence is completed, depending on the purchase specification, it will either recycle or turn off. At turn-off three things occur:

- A. The "operate" light goes out and the "finished" light comes on and stays on.
- B. A loud bell rings for approximately one second.
- C. Logic power turns off.

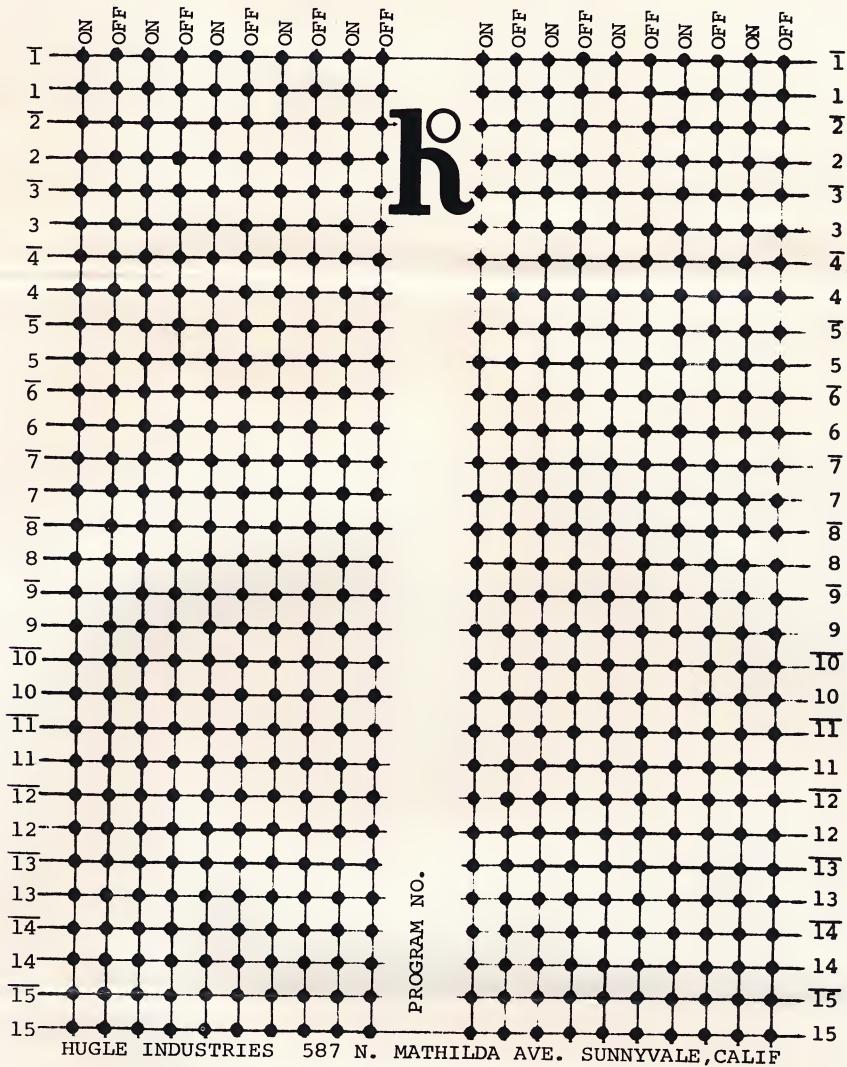
## TIME PROPORTIONATION:

The PCD series can be supplied with time proportionation on one or more channels. This is especially useful in controlling very small gas flows. Hugle Industries offers diffusion and epitaxial doping systems with fixed orifices replacing needle valves on one or more critical gas lines. The flow rate is controlled by the ratio of open/closed time of the solenoid valve. The duty cycle is quickly and easily programmed on the same programming board that controls the other events in the processing sequence. The Hugle Industries PCD 10 Interval Timer uses one pair of signals (i.e. 2 of the 20 control lines) to define the start and finish times of the doping cycle. Minimum on (or off) time is  $\frac{1}{2}$  second. For a 50 per cent duty cycle, the solenoid valve would open and close every  $\frac{1}{2}$  second. For a 10 per cent duty cycle, the valve is open  $\frac{1}{2}$  second, closed 4- $\frac{1}{2}$  seconds. etc.

## PROGRAMMING:

The start and stop times for each channel are programmed by inserting pins into the program board. To avoid the possibility of error, as well as to maintain a permanent record, a plastic program card is punched to receive the pins and placed over the program board. The program card has a place for program identification and authorizing signatures. (See illustration)

A programming manual and time conversion chart are supplied with each unit. No calculations are necessary. A ten channel program can be written and punched in less than 5 minutes without any special skills or training. Programs not in use can be stored indefinitely and a program can be changed in 2 or 3 minutes.



## VARIABLE TIME BASE OPTION:

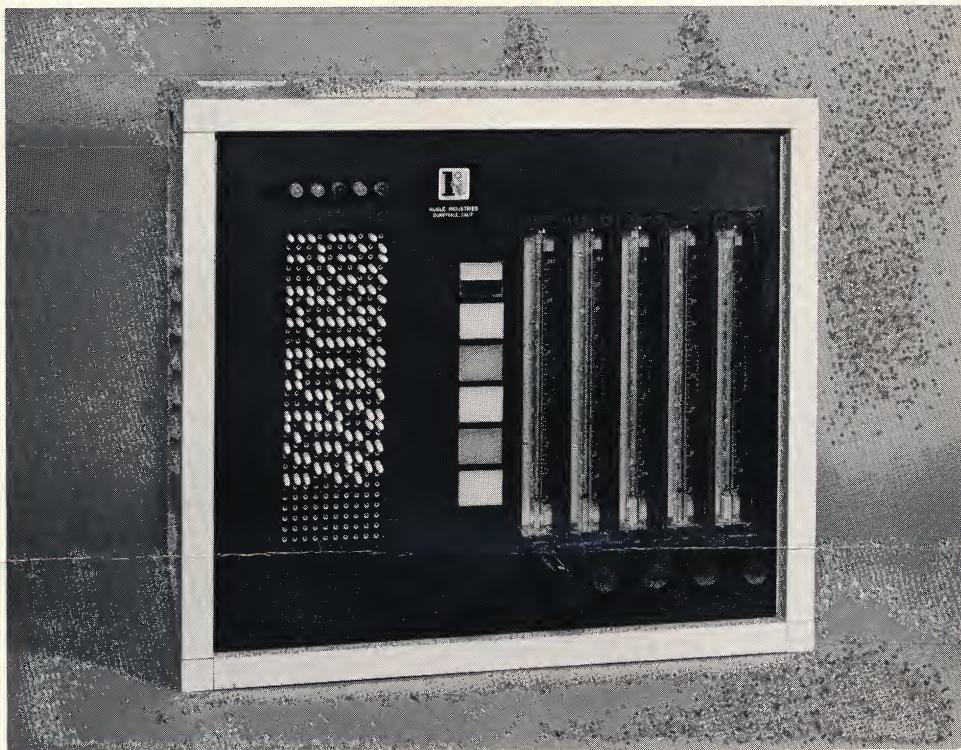
The standard PCD series uses the 60 cycle line as its basic clock, for highly accurate timing. However, for special applications, like some automated assembly lines, the VTB-PCD series uses a free running multivibrator with a potentiometer on the control panel so the entire process can be speeded up or slowed down over a 10:1 ratio without changing the program. This is analogous to using a variable speed motor to drive a series of cams. Whereas the PCD series has a lower resolution limit of 8 milliseconds, no such limit exists for the VTB-PCD series, except that the resolution can not be better than one part in 4,095 of full scale.

**PRICE AND DELIVERY:**

Model	PCD 5	\$1,400	6- 8 weeks A.R.O.
	PCD 10	\$1,900	6- 8 weeks A.R.O.
	PCD 15	\$2,600	7- 9 weeks A.R.O.
	PCD 20	\$3,200	7- 9 weeks A.R.O.
	VTB-PCD 5	\$1,700	8-10 weeks A.R.O.
	VTB-PCD 10	\$2,100	8-10 weeks A.R.O.
	VTB-PCD 15	\$2,800	8-10 weeks A.R.O.
	VTB-PCD 20	\$3,400	8-10 weeks A.R.O.

**PHYSICAL DIMENSIONS:**

This unit can be packaged to fit your space either as a table mount or a panel mount. The approximate size of PCD 10 is 11 inches high x 9 inches wide x 10 inches deep.



GASEOUS DOPING SYSTEM WITH PCD 5 CONTROLLER



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